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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : H04Q 7/22

A1

(11) International Publication Number: **WO 95/26113**

(43) International Publication Date: 28 September 1995 (28.09.95)

(21) International Application Number: PCT/US95/03046

(22) International Filing Date: 14 March 1995 (14.03.95)

(30) Priority Data:
08/215,817 22 March 1994 (22.03.94) US

(71) Applicant: MOBILE TELECOMMUNICATION TECHNOLOGIES [US/US]; P.O. Box 2469, Jackson, MS 39225 (US).

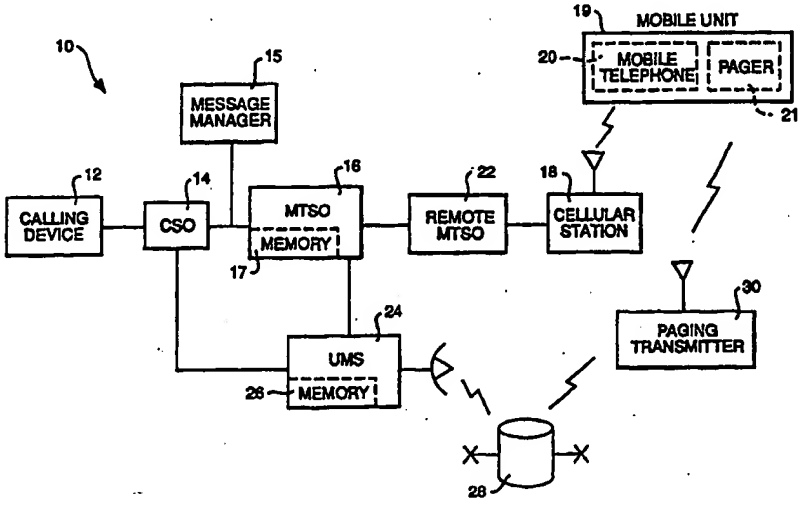
(72) Inventors: HAYS, William, D.; 2345 Twin Lake Circle, Jackson, MS 39211 (US). ACKERMAN, David; 3730 W Street, N.W., Washington, DC 20007 (US). WARFIELD, Donald; Apartment 52, 527 West 110th Street, New York, NY 10025 (US).

(74) Agents: GARRETT, Arthur, S. et al.; Finnegan, Henderson, Farabow, Garrett & Dunner, 1300 I Street N.W., Washington, DC 20005-3315 (US).

(81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MN, MW, MX, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TT, UA, UG, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD, SZ, UG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: DATA TRANSMISSION IN A MIXED MOBILE CELLULAR/PAGING RADIO SYSTEM



(57) Abstract

A telecommunication system is disclosed which allows messages to be transmitted via a cellular phone channel and a paging channel to a mobile unit having both a mobile telephone and a page receiver. The telecommunication system receives a data message for a subscriber from a calling device, which is routed to a mobile telephone switching office (MTSO) via a central switching office. The MTSO can transmit a data message to the mobile telephone in the mobile unit via a cellular phone channel, and can also send a message to a Universal Messaging System (UMS) to be sent to a pager in the mobile unit via a paging channel. When the system is unable to deliver a data message to the mobile telephone via the cellular channel, it can store the message at the UMS or MTSO and send an alerting message to the mobile unit via the paging channel indicating that a message has been stored for later retrieval. Alternatively, the system can send the entire data message via the paging channel.

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Data Transmission in a Mixed Mobile Cellular/Paging Radio System

Background of the Invention

1. Field of the Invention

The present invention relates to telecommunication networks and methods. In particular, the present invention relates to telecommunication networks for transmitting digital data to mobile subscribers.

2. Description of Related Art

Conventional cellular telephone systems in use today are primarily designed for full duplex two-way analog voice service. One example of these systems is Advanced Mobile Phone Service (AMPS). These systems can also be utilized for two-way, but not for "connectionless" one-way, transmission of data over analog channels. Connectionless one-way transmission refers to simultaneous broadcasting of data to one or more receivers, which cannot be performed by conventional cellular telephone systems that require each receiver to establish a connection with a Mobile Telephone Switching Office (MTSO) or cellular station before data can be transmitted to the receiver.

Enhanced data transmission schemes for both analog and digital cellular transmission are being developed. An example of such a system is Cellular Digital Packet Data (CDPD), now being developed by a consortium of U.S. cellular carriers together with International Business Machines for initial deployment in the United States. CDPD consists of equipment and software which overlays existing cellular infrastructure and allows for digital data to be multiplexed in packets for transmission during "idle" times on cellular voice channels. CDPD also allows for use of dedicated data channels if traffic or loading factors make dedicated channels more attractive.

Other systems are being developed to provide both voice and data transmission over digital cellular systems. Examples of these systems include Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA), and Global System for Mobile

Communications (GSM). GSM, developed by the European Telecommunications Standards Institute (ETSI), is intended primarily for use in Europe and will function in analog and certain contemplated digital environments, including TDMA, but will not function in other digital environments including CDMA.

These new technologies provide cellular systems with new capabilities and substantial benefits, such as data transmission via AMPS switched analog circuits (in the case of CDPD) and via digital channels (such as GSM), increased reliability, and increased capacity. Because of these benefits, many companies are developing mobile units that receive and process data transmitted via a cellular carrier.

These technologies will, however, continue to suffer disadvantages inherent in cellular services today. These disadvantages include drain on available battery power in the mobile unit (due both to "stand-by" requirements for receipt of data sent at non-preset times and the likelihood that both the cellular receiver and the computer processor in the mobile unit utilize the same rechargeable battery); limited coverage; comparatively poor building penetration because of low transmission power and lack of simulcasting capabilities; absence of seamless nationwide roaming capabilities; relatively poor successful transmission performance due to disconnects and data loss caused either by "spotty" coverage or by problems at cell-to-cell "hand offs"; and a lack of "connectionless," one-way, point-to-point and point-to-multipoint broadcast messaging.

Thus, although today's cellular-based wireless data transmission technologies provide acceptable reliability for data transmissions from single base stations in ideal coverage circumstances, for many data application this technology is simply not reliable enough.

Summary of the Invention

Accordingly, the present invention is directed to an improved telecommunication system that substantially obviates

one or more of the limitations and disadvantages of the related art.

To achieve this and other objects and advantages, and in accordance with the purposes of the invention, as embodied and broadly described herein, the invention comprises a telecommunications network, including means for receiving digital data, memory means for storing the digital data, first transmitting means for transmitting the digital data via a cellular phone channel, second transmitting means for transmitting a page message via a paging channel, determining means for determining whether the digital data can be successfully transmitted to a subscriber by said first transmitting means, and means for transmitting a predetermined page message to the subscriber via said second transmitting means when said determining means determines that the digital data cannot be successfully transmitted to the subscriber by said first transmitting means.

The invention also comprises a method, including the steps of: receiving at a central station digital data for a subscriber, attempting to deliver the digital data to a subscriber mobile unit via a cellular phone channel, determining that the attempt to deliver the digital data to the subscriber mobile unit via the cellular phone channel was not successful, storing the digital data in a memory, transmitting a predetermined page message to the subscriber mobile unit via a paging channel, and retrieving by the subscriber mobile unit via said cellular phone channel said digital data from said memory means upon receipt of said predetermined page message.

The present invention provides specific benefits and improvements in the provision of cellular data transmission in AMPS, CDPD, GSM, and other modes, which benefits and improvements include, but are not limited to: power savings and concomitant increased battery life between recharges; increased coverage, even where cellular coverage may be absent, incomplete or unreliable; increased building penetration; seamless nationwide and international roaming capabilities; enhanced

service options and subscriber profiling/screening/filtering options providing least-cost-routing capabilities and economies; and "connectionless" broadcast services and resultant economies.

It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate an embodiment of the invention and together with the description serve to explain the principles of the invention.

Brief Description of the Drawings

Fig. 1 is a block diagram of a preferred embodiment of the telecommunications system of the invention.

Fig. 2 is a block diagram of a mobile unit, in accordance with one embodiment of the present invention.

Fig. 3 is a flow chart showing a first method of operation of a telecommunications system in accordance with one embodiment of the present invention.

Fig. 4 is a flow chart showing a second method of operation of a telecommunications system in accordance with one embodiment of the present invention.

Figs. 5A and 5B are flow charts showing a third method of operation of a telecommunications system in accordance with one embodiment of the present invention.

Fig. 6 is a flow chart showing a fourth method of operation of a telecommunications system in accordance with one embodiment of the present invention.

Fig. 7 is a flow chart showing a fifth method of operation of a telecommunications system in accordance with one embodiment of the present invention.

Fig. 8 is a flow chart showing a sixth method of operation of a telecommunications system in accordance with one embodiment of the present invention.

Description of the Preferred Embodiments

As shown in Fig. 1, a preferred telecommunications system 10 includes a calling device 12, a Central Switching Office ("CSO") 14, a Message Manager 15, a Mobile Telephone Switching Office (MTSO) 16, a cellular station 18, a mobile unit 19 having a mobile telephone 20 and a pager 21, a remote MTSO 22, a Universal Messaging System ("UMS") 24, a satellite 28, and a paging transmitter 30.

Calling device 12 can be any device capable of transmitting digital data over telephone lines, such as a telephone, a computer, or some other data terminal device. A caller may enter a data message directly or request an operator to enter the message. Alternatively, the message may be automatically generated by calling device 12, when, for example, it is connected to a stock market or news reporting service.

As shown, calling device 12 is connected to CSO 14 in a conventional manner. In one embodiment, CSO 14 routes data messages received from calling device 12 to message manager 15. Message manager 15 is a central clearinghouse for storing and managing data messages received from calling devices and intended for subscribers. Although message manager 15 is shown between CSO 14 and MTSO 16 in Fig. 1, it could also be located between calling device 12 and CSO 14. In such a case, message manager 15 could be a local area network (LAN) or other proprietary system for storing and managing messages from a plurality of calling devices.

CSO 14 routes calls destined for mobile unit 19 to MTSO 16. MTSO 16 receives and processes calls from CSO 14 and routes calls to and from cellular station 18 via remote MTSO 11 in systems requiring more than one MTSO. For example, if the cellular system provides for locating roaming subscribers and MTSO 16 determines that mobile unit 19 is outside its service area, MTSO 16 can send the message to a remote MTSO 22 which services the area in which mobile unit 19 is located. Cellular station 18 transmits to and receives signals from mobile telephone 20 via a cellular channel.

MTSO 16 preferably includes memory 17 which can be used to store data messages for subscribers. Memory 17 may be any conventional storage medium such as magnetic disk, tape, optical memory, or integrated circuit (IC) memory.

CSO 14 and MTSO 16 are preferably connected to UMS 24. UMS 24 is preferably a central computer for a paging system, such as the UMS owned and operated by SkyTel Corporation in Washington, D.C. UMS 24 contains memory 26 which can be used to store data messages transmitted to it by MTSO 16. Memory 26 may also be any conventional data storage medium, such as magnetic disk, tape, optical memory, or IC memory. UMS 24 sends out paging messages via satellite 28 to regional paging transmitter 30, which in turn, transmits paging messages throughout a desired geographic area.

Telecommunications system 10 also includes a mobile unit 19 which includes both a mobile telephone 20 and a pager 21. For example, mobile unit 19 may comprise a combined mobile telephone and pager like that described in U.S. Patent No. Re 33,417, the contents of which are hereby incorporated by reference. Mobile unit 19 could alternatively comprise other conventional cellular based data messaging devices having page receivers.

Fig. 2 illustrates a block diagram of an exemplary mobile unit 19. As shown in Fig. 2, mobile unit 19 includes mobile telephone 20, pager 21, pager control unit 204, memory 206, control switches 208, display 210, mobile telephone control unit 212, memory 218, automatic dialer 220, and battery 222. Mobile telephone 20 includes mobile cellular telephone 214, cellular digital data processing unit 215, and cellular RF antenna 216. Pager 21 includes RF antenna 200 and radio pager 202. In accordance with the present invention, data messages can be received by either mobile telephone 20 or pager 21 of mobile unit 19.

Pager 21 is preferably a conventional page receiver, including RF antenna 200 for receiving RF page signals, and a radio pager 202 coupled to RF antenna 200. Radio pager 202 converts paging signals received from RF antenna 200 into data

signals representing a page message. The page message can be, for example, a short message, such as an indication that a message is waiting or an instruction to turn on the mobile telephone, or a longer message, such as a data message sent by a caller.

In a preferred embodiment of the present invention, mobile telephone 20 is configured to accommodate cellular digital data, as well as voice communications. For example, mobile telephone 20 may be configured to accommodate CDPD, including wide band and narrow band CDPD, GSM, TDMA, CDMA, etc. techniques, as well as future techniques that transmit digital data over a cellular channel. Mobile telephone 20 includes a conventional cellular RF antenna 216 coupled to mobile cellular telephone 214. Mobile cellular telephone 214 is coupled to cellular digital data processing unit 215, which processes digital data received from mobile cellular telephone 214 via a cellular channel and processes digital data to be sent to mobile cellular telephone 214 to be transmitted via a cellular channel.

Pager control unit 204 performs control functions on radio pager 202 and interfaces with mobile telephone 20 through mobile telephone control unit 212. Memory 206 coupled to pager control unit 204 stores messages received from radio pager 202. Control switches 208 are coupled to pager control unit 204 and allow the subscriber to enter commands for mobile unit 19. Display 210 is coupled to pager control unit 204 and displays page messages received by radio pager 202 and prompts to the subscriber.

Mobile telephone control unit 212 is coupled to mobile cellular telephone 214 and cellular digital data processing unit 215. Mobile telephone control unit 212 controls mobile telephone 20 and also interfaces with pager 21 through pager control unit 204.

Memory 218 is coupled to mobile telephone control unit 212 and stores messages received from cellular digital data processing unit 215. Automatic dialer 220 is coupled to mobile telephone control unit 212 and automatically causes the mobile cellular telephone 214 to place a call upon receipt of

information instructing it to do so, such as a telephone number or network address. Battery 222 supplies power to all the components of mobile unit 19.

Display 210 is coupled to both pager control unit 204 and mobile telephone control unit 212 and displays messages from pager 21 and mobile telephone 20.

A first method of operation of the telecommunication system of Fig. 1 will be described in conjunction with the flow diagram of Fig. 3. Initially, a caller at calling device 12 enters a data message to be sent to a particular subscriber's mobile unit 19 (step 100). The data message entered in step 100 is received by CSO 14 (step 102). When CSO 14 determines that the call is destined for mobile unit 19, it routes the call to the appropriate MTSO 16, where it is received (step 104). The MTSO 16 then determines whether the received call is valid (step 106), and if not, sends an error message to the caller (step 108). If the received call is valid (step 106), MTSO 16 attempts to handshake with the mobile telephone 20 of mobile unit 19 (step 110) via conventional techniques. In some systems, cellular station 18, rather than MTSO 16, attempts to handshake with the mobile unit 19. If MTSO 16 knows that mobile unit 19 is presently in an area serviced by a remote MTSO 22, remote MTSO 22 (or a corresponding cellular station) attempts to handshake with the mobile unit 19. MTSO 16 then determines whether the attempt to handshake has been successful (step 112). If so, MTSO 16 connects the call and sends the data message to the mobile telephone 20 via a cellular channel (step 114). However, the attempt to handshake may not be successful for a variety of reasons. For example, mobile telephone 20 of mobile unit 19 may be turned off, in which case it will not respond to the handshake signal from the MTSO 16. Or, the mobile unit 19 might be located in a remote area not serviced by the cellular network. Mobile unit 19 might also be located in an area that the cellular signal cannot penetrate, such as in a building or below ground. In such cases, the MTSO 16 would receive either

no response or a weak response from mobile telephone 20, indicating that communication would be unreliable.

If the MTSO determines in step 112 that the attempt to handshake with mobile telephone 20 is not successful, MTSO 16 routes the data message entered by the caller to UMS 24 (step 116). The UMS 24 stores the data message in memory 26 (step 118), and transmits a page message to the pager 21 in mobile unit 19 (step 120). The page message informs the subscriber that he or she has a data message stored at the UMS 24.

The page message is received by pager 21 of mobile unit 19 (step 122), which responds by alerting the subscriber by display, tone, vibration, etc. (step 123) and determining whether mobile telephone 20 is turned off (step 124).

If mobile unit 19 determines that mobile telephone 20 is turned off, mobile unit 19 automatically turns on mobile telephone 20 (step 128). Alternatively, mobile unit 19 may be configured such that the subscriber manually turns on the mobile telephone 20. If the mobile telephone 20 is on, or once it is on, mobile unit 19 instructs mobile telephone 20 to automatically dial the telephone number of UMS 24 (step 130). Alternatively, the subscriber could dial this telephone number manually. Mobile telephone 20 then attempts to handshake with the MTSO 16 (step 132), or a remote MTSO 22 if located in an area not serviced by MTSO 16. Mobile telephone 20 then determines whether the attempt to handshake is successful (step 134). If the attempt to handshake is not successful, the subscriber must get to a land-line telephone or wait until he or she is in a serviceable area to retrieve the message (step 135). By using a land-line telephone, the subscriber can call from any location and retrieve the stored message by connecting to the UMS 24 through the CSO 14.

If the attempt to handshake with the MTSO 16 (step 132) is successful, mobile telephone 20 automatically retrieves the data message for the subscriber from UMS 24 via the MTSO 16 (step 136). Mobile unit 19 then displays the stored message (step 138). This method allows the called subscriber to conserve

battery power in mobile unit 19 by turning off mobile telephone 20, while still being able to receive data messages.

A second method of operation of the telecommunications system of Fig. 1 will now be described below in conjunction with the flow chart of Fig. 4. In Fig. 4, steps 100-116 are identical to the corresponding steps in Fig. 3. After the data message entered at calling device 12 is sent to UMS 24 (step 116), UMS 24 sends the entire data message to pager 21 of mobile unit 19 via the paging channel (step 300). In this case, the data message need not be stored at UMS 24. UMS 24 transmits the data message to pager 21 via satellite 28 and paging transmitter 30. Pager 21 receives the data (step 302), and mobile unit 19 displays the data (step 304). This method allows data messages to be immediately delivered to the subscriber when mobile telephone 20 is out of range or turned off.

A third method of operation of the telecommunications system of Fig. 1 will be described below in conjunction with the flow charts of Figs. 5A-5B. The method shown in Figs. 5A-5B is a "meet-me" type system which preferably allows a data message to be sent to mobile unit 19 without storing the data message at UMS 24. In Fig. 5A, the caller enters a subscriber's mobile unit telephone number at calling device 12 (step 400). The telephone number is transmitted to and received by CSO 14 (step 402), then transmitted to and received by MTSO 16 (step 404). The validity of the call is then checked (step 406). If the call is not valid, an error message is sent to the caller (step 408). If the call is valid, the MTSO 16 attempts to handshake with mobile telephone 20 of mobile unit 19 (steps 410 and 412). If the handshake is successful, the call is connected (step 414). If not, MTSO 16 sends a message to UMS 24 (step 416). This message preferably indicates that an incoming call awaits the caller or, alternatively, also includes the caller's telephone number. UMS 24 then transmits a page message to mobile unit 19 (step 418), which receives the message at pager 21 (step 420). Again, this page message preferably informs the

mobile unit 19 that a call awaits the subscriber or, alternatively, also includes the caller's telephone number.

Mobile unit 19 then determines whether mobile telephone 20 is on or off (step 422). If mobile telephone 20 is off, mobile unit 19 turns on mobile telephone 20 (step 426). Once the mobile telephone 20 is on, mobile unit 19 instructs mobile telephone 20 to automatically dial the telephone number of MTSO 16 (step 428). Mobile telephone 20 then attempts to handshake with the MTSO 16 (step 430) and determines whether the attempt to handshake is successful (step 432). If the attempt to handshake is not successful, the mobile unit 19 must be located in an area that cannot be reached either reliably or at all by the cellular network. As a result, mobile telephone 20 indicates that a call awaits the subscriber (step 433). The subscriber can then either use a land-line telephone or wait until he or she is in a serviceable area to attempt to reach the caller or retrieve a message. If the attempt to handshake with the MTSO 16 (step 432) is successful, MTSO 16 connects the caller to mobile telephone 20 (step 434). The caller and the mobile telephone 20 can also be connected through a message manager 15 which functions as a buffered memory for temporarily storing and transferring data messages between the caller and the mobile telephone 20.

Fig. 5B illustrates the interaction between calling device 12 and MTSO 16 during the method of Fig. 5A. After the caller dials the telephone number of mobile unit 19 (step 430), MTSO 16 places the caller in a holding state and determines whether a response has been received from mobile telephone 20 (step 432). If a response has been received, the call is connected (step 434), and a data message can be sent from the calling device 12 to mobile telephone 20 via the cellular network. If no response has been received from mobile telephone 20, MTSO 16 determines whether a timer has timed out, indicating that a specified time has passed (step 436). If the timer has not timed out, the MTSO continues to wait for a response from mobile telephone 20. If the timer has timed out, MTSO 16 informs the caller that the

call cannot be connected at the present time (step 438). MTSO 16 next determines whether the caller wishes to leave a message (step 440). If not, the caller is disconnected from the MTSO 16 (step 442). If the caller wishes to leave a message, then the calling device 12 sends the message to the UMS 24 via MTSO 16 (step 444). The UMS stores the message for later retrieval by the subscriber (step 446).

A fourth method of operation of the telecommunications system of Fig. 1 will be described below in conjunction with the flow chart of Fig. 6. This operation is preferably similar to that of Fig. 3 except that data messages entered by the calling party are stored in memory 17 of MTSO 16 rather than memory 26 of UMS 24. In Fig. 6, after the call is determined to be valid (step 106), the data message is stored in MTSO memory 17 (step 109). Later, if the MTSO 16 determines that the attempt to handshake with mobile telephone 20 was not successful (step 112), the MTSO 16 sends a message to UMS 24 (step 116') which preferably indicates that an incoming data message awaits the caller or also includes the caller's telephone number or network address. The operation then proceeds directly to the sending out of a page message by UMS 24 (step 120). After mobile telephone 20 has been turned on (step 128), or if it is already on, mobile telephone automatically or manually dials into MTSO 16 (step 130'). After mobile telephone 20 successfully handshakes with MTSO 16 (step 134), mobile telephone 20 automatically retrieves the data message stored in memory 17 of MTSO 16 (step 136').

A fifth method of operation of the telecommunications system of Fig. 1 will be described below in conjunction with the flow chart of Fig. 7. This operation is preferably similar to that of Fig. 3 except that data messages entered by the calling party are stored in message manager 15 rather than in memory 26 of UMS 24. In Fig. 7, after the data message is received by CSO 14 (step 102), the data message is sent to and stored in message manager 15 (step 103). Later, if the MTSO 16 determines that the attempt to handshake with mobile telephone 20 was not

successful (step 112), the MTSO 16 sends a message to UMS 24 (step 116'') which preferably indicates that an incoming data message awaits the caller or, alternatively, also includes the caller's telephone number or network address. The operation then proceeds directly to the step of sending out of a page message by UMS 24 (step 120). After mobile telephone 20 has been turned on (step 128), or if it is already on, mobile telephone automatically or manually dials the number of message manager 15 (step 130''). After mobile telephone 20 successfully handshakes with MTSO 16 (step 134), mobile telephone 20 automatically retrieves the data message stored in message manager 15 (step 136'').

A sixth method of operation of the telecommunications system of Fig. 1 will be described below in conjunction with the flow chart of Fig. 8. This method allows a caller to broadcast a data message to one or more mobile units, and thus allows the telecommunications system to be utilized for "connectionless" one way transmission of data, which cannot be performed by conventional cellular telephone systems. Initially, a central station, such as CSO 14, receives from calling device 12 a data message and one or more destination addresses of one or more mobile units to which the data message is to be sent (step 500). A destination address can be the address of a particular mobile unit or a broadcast address identifying a group of mobile units. CSO 14 then determines whether the received call is valid (step 502), and if not, sends an error message to the caller (step 504). If the received call is valid (step 502), CSO 14 checks whether the destination address(es) require the data message to be broadcast to one or more mobile units (step 506). If the data message does not need to be broadcast (step 508), CSO 14 sends the data message to MTSO 16, which sends the data message to the proper mobile unit via a cellular channel (step 510). If the data message requires broadcasting (step 508), CSO 14 sends the data message to UMS 24 (step 512). Steps 500-512 are not required to be performed at CSO 14, and may be performed at Message Manager 15, MTSO 16, or any other suitable location.

In step 514, UMS 24 broadcasts the data message to one or more pagers 21 identified by the destination address(es). UMS 24 transmits the data message to pager(s) 21 via satellite 28 and paging transmitter 30. Pager(s) 21 receive the data (step 516), and mobile unit(s) 19 display the data message (step 518). This method allows for "connectionless," one way, point-to-point and point-to-multipoint broadcast messaging not found in conventional cellular systems.

It will be apparent to those skilled in the art that various modifications and variations can be made in the telecommunications system and method of the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

What is Claimed is:

1. A telecommunications system, comprising:

means for receiving digital data;

memory means for storing the digital data;

first transmitting means for transmitting the digital data via a cellular phone channel;

second transmitting means for transmitting a page message via a paging channel;

determining means for determining whether the digital data can be successfully transmitted to a subscriber by said first transmitting means; and

means for transmitting a predetermined page message to the subscriber via said second transmitting means when said determining means determines that the digital data cannot be successfully transmitted to the subscriber by said first transmitting means.

2. The telecommunications system of claim 1, wherein said first transmitting means transmits the digital data using Cellular Digital Packet Data (CDPD) protocol.

3. The telecommunications system of claim 1, wherein said first transmitting means transmits the digital data using Global System for Mobile Communication (GSM) protocol.

4. The telecommunications system of claim 1, wherein said first transmitting means transmits the digital data using Time Division Multiple Access (TDMA) protocol.

5. The telecommunications system of claim 1, wherein said first transmitting means transmits the digital data using Code Division Multiple Access (CDMA) protocol.

6. The telecommunications system of claim 1, wherein said second transmitting means includes a universal messaging system (UMS), and said memory means is located at said UMS.

7. The telecommunications system of claim 1, wherein said first transmitting means comprises a mobile telephone switching office (MTSO), and said memory means is located at said MTSO.

8. The telecommunications system of claim 1, further comprising a message manager for storing and managing digital

data messages, wherein said memory means is located at said message manager.

9. The telecommunications system of claim 1, further comprising:

a mobile unit, including

a mobile telephone;

a page receiver;

first receiver means for receiving digital data via a cellular phone channel;

second receiver means for receiving a page message via a paging channel; and

means for instructing said mobile telephone to retrieve via said cellular phone channel said digital data from said memory means upon receipt of said predetermined page message.

10. The telecommunications system of claim 9, where said instructing means comprises:

means for determining whether said mobile telephone is on or off; and

means for turning on said mobile telephone when said mobile telephone is off.

11. The telecommunications system of claim 1, further comprising:

means for placing a calling party in a holding state;

a mobile unit, including

a mobile telephone,

a page receiver,

first receiver means for receiving digital data via a cellular phone channel,

second receiver means for receiving a page message via a paging channel, and

means for instructing said mobile telephone to initiate a call to said first transmitting means via said cellular phone channel upon receipt of said predetermined page message; and

means for connecting said calling party to said mobile telephone via said cellular phone channel.

12. The telecommunications system of claim 11, where said instructing means comprises:

means for determining whether said mobile telephone is on or off; and

means for turning on said mobile telephone when said mobile telephone is off.

13. A mobile unit, comprising:

a mobile telephone;

a page receiver;

first receiver means for receiving digital data via a cellular phone channel;

second receiver means for receiving a page message via a paging channel;

means for determining whether a predetermined page message has been received indicating that a data message is waiting for the subscriber at a remote location; and

means for instructing said mobile telephone to retrieve via said cellular phone channel said data message from said remote location upon receipt of a predetermined page message.

14. The telecommunications system of claim 13, where said instructing means comprises:

means for determining whether said mobile telephone is on or off; and

means for turning on said mobile telephone when said mobile telephone is off.

15. A telecommunications system, comprising:

means for receiving digital data;

memory means for storing the digital data;

first transmitting means for transmitting the digital data via a cellular phone channel;

second transmitting means for transmitting a page message via a paging channel;

determining means for determining whether the digital data can be successfully transmitted to a subscriber by said first transmitting means; and

means for transmitting the digital data to the subscriber via said second transmitting means when said determining means determines that the digital data cannot be successfully transmitted to the subscriber by said first transmitting means.

16. A telecommunications method, comprising the steps of:

receiving at a central station digital data for a subscriber;

attempting to deliver the digital data to a subscriber mobile unit via a cellular phone channel;

determining that the attempt to deliver the digital data to the subscriber mobile unit via the cellular phone channel was not successful;

storing the digital data in a memory;

transmitting a predetermined page message to the subscriber mobile unit via a paging channel; and

retrieving by the subscriber mobile unit via said cellular phone channel said digital data from said memory means upon receipt of said predetermined page message.

17. The telecommunications system of claim 16, where said retrieving step includes the steps of:

determining whether a mobile telephone in the subscriber mobile unit is on or off; and

turning on said mobile telephone when said mobile telephone is off.

18. The method of claim 16, wherein said cellular phone channel uses Cellular Digital Packet Data (CDPD) protocol.

19. The method of claim 16, wherein said cellular phone channel uses Global System for Mobile Communication (GSM) protocol.

20. The method of claim 16, wherein said cellular phone channel uses Time Division Multiple Access (TDMA) protocol.

21. The method of claim 16, wherein said cellular phone channel uses Code Division Multiple Access (CDMA) protocol.

22. The method of claim 16, wherein said memory is located at a Universal Messaging System (UMS).

23. A telecommunications method, comprising the steps of:

receiving at a central station digital data for a subscriber;

attempting to deliver the digital data to the subscriber via a cellular phone channel;

determining whether the attempt to deliver the digital data to the subscriber via the cellular phone channel was successful; and

transmitting the digital data to the subscriber via a paging channel when it is determined that the attempt to deliver the digital data via the cellular phone channel was not successful.

24. The method of claim 23, wherein said cellular phone channel uses Cellular Digital Packet Data (CDPD) protocol.

25. The method of claim 23, wherein said cellular phone channel uses Global System for Mobile Communication (GSM) protocol.

26. The method of claim 23, wherein said cellular phone channel uses Time Division Multiple Access (TDMA) protocol.

27. The method of claim 23, wherein said cellular phone channel uses Code Division Multiple Access (CDMA) protocol.

28. A telecommunications method, comprising the steps of:

receiving at a central station digital data sent by a calling party to a subscriber;

placing the calling party in a holding state;

attempting to deliver the digital data to a subscriber mobile unit including a mobile telephone via a cellular phone channel;

determining that the attempt to deliver the digital data to the subscriber mobile unit via the cellular phone channel was not successful;

transmitting a predetermined page message to the subscriber mobile unit via a paging channel;

receiving said predetermined page message at the subscriber mobile unit;

instructing said mobile telephone in said subscriber mobile unit to initiate a call to said central station via said cellular phone channel upon receipt of said predetermined page message; and

connecting the calling party to said mobile telephone via said cellular phone channel.

29. The telecommunications system of claim 28, where said receiving step includes the steps of:

determining whether said mobile telephone in said subscriber mobile unit is on or off; and

turning on said mobile telephone when said mobile telephone is off.

30. The method of claim 28, wherein said cellular phone channel uses Cellular Digital Packet Data (CDPD) protocol.

31. The method of claim 28, wherein said cellular phone channel uses Global System for Mobile Communication (GSM) protocol.

32. The method of claim 28, wherein said cellular phone channel uses Time Division Multiple Access (TDMA) protocol.

33. The method of claim 28, wherein said cellular phone channel uses Code Division Multiple Access (CDMA) protocol.

34. A telecommunications method, comprising the steps of:

receiving at a central station digital data for a subscriber;

storing the digital data in a memory;

attempting to deliver the digital data to a subscriber mobile unit via a cellular phone channel;

determining that the attempt to deliver the digital data to the subscriber mobile unit via the cellular phone channel was not successful;

transmitting a predetermined page message to the subscriber mobile unit via a paging channel;

retrieving by the subscriber mobile unit via said cellular phone channel said digital data from said memory means upon receipt of said predetermined page message.

35. The method of claim 34, where said retrieving step includes the steps of:

determining whether a mobile telephone in the subscriber mobile unit is on or off; and

turning on said mobile telephone when said mobile telephone is off.

36. The method of claim 34, wherein said cellular phone channel uses Cellular Digital Packet Data (CDPD) protocol.

37. The method of claim 34, wherein said cellular phone channel uses Global System for Mobile Communication (GSM) protocol.

38. The method of claim 34, wherein said cellular phone channel uses Time Division Multiple Access (TDMA) protocol.

39. The method of claim 34, wherein said cellular phone channel uses Code Division Multiple Access (CDMA) protocol.

40. The method of claim 34, wherein said memory is located at a Mobile Telephone Switching Office (MTSO).

41. The method of claim 34, wherein said memory is located at a Message Manager.

42. A telecommunications method, comprising the steps of:

receiving at a central station digital data for one or more subscribers;

determining whether the digital data is to be broadcast to said one or more subscribers;

transmitting the digital data to said one or more subscribers via a cellular channel when it is determined that the digital data is not to be broadcast; and

transmitting the digital data to said one or more subscribers via a paging channel when it is determined that the digital data is to be broadcast.

43. The method of claim 42, wherein said receiving step includes the step of receiving at least one destination address along with the data message, and said determining step

determines whether the digital data is to be broadcast based on said at least one destination address.

44. The method of claim 43, wherein said at least one destination address includes a broadcast address identifying a group of subscribers to which the data message is to be broadcast.

45. A telecommunications system, comprising:

means for receiving digital data;

determining means for determining whether the digital data is to be broadcast to one or more subscribers;

first transmitting means for transmitting the digital data to said one or more subscribers via a cellular channel when it is determined that the digital data is not to be broadcast; and

second transmitting means for transmitting the digital data to said one or more subscribers via a paging channel when the determining means determines that the digital data is to be broadcast.

46. The method of claim 45, wherein said receiving means receives at least one destination address along with the data message, and said determining means determines whether the digital data is to be broadcast based on said at least one destination address.

47. The method of claim 46, wherein said at least one destination address includes a broadcast address identifying a group of subscribers to which the data message is to be broadcast.

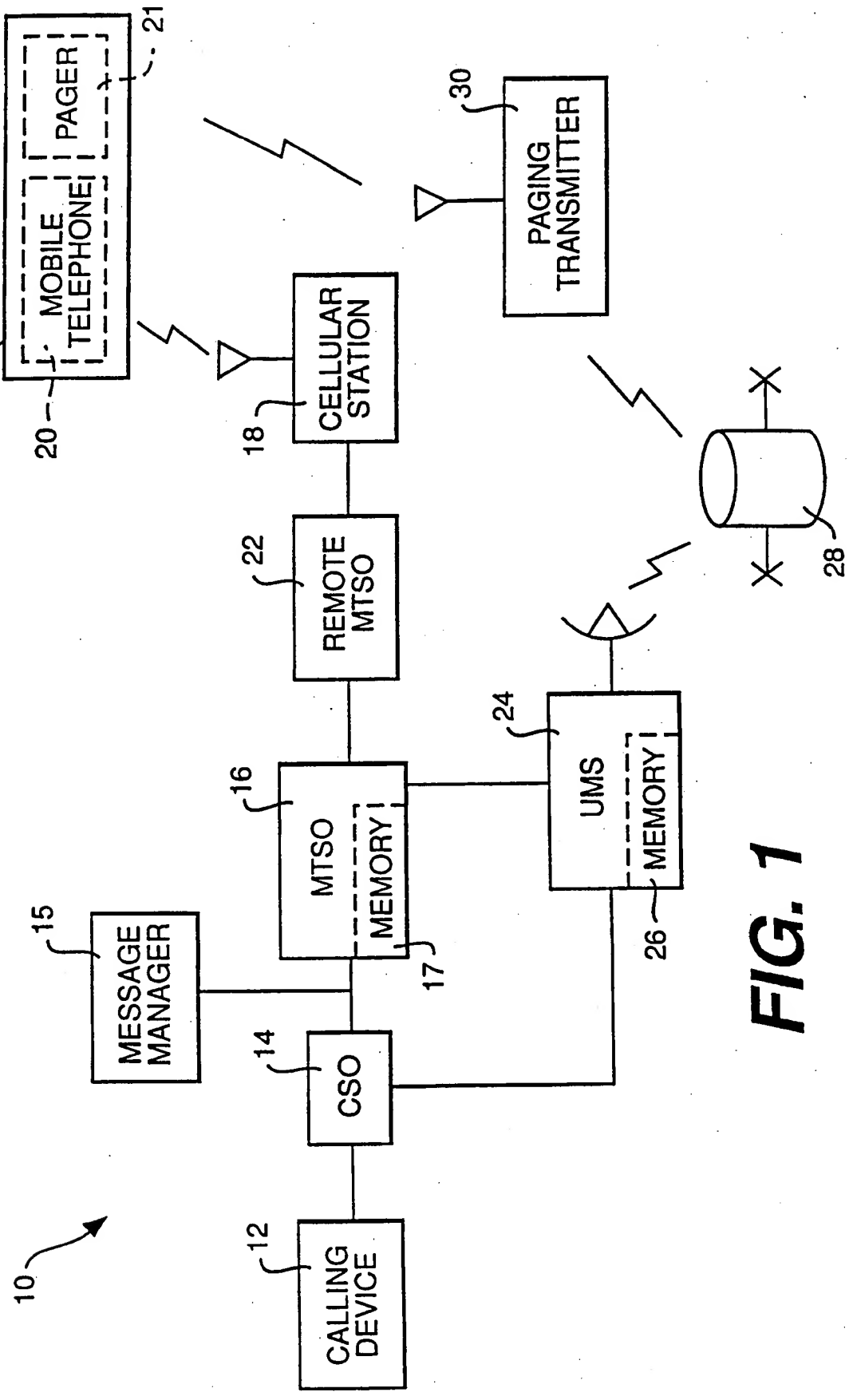
MOBILE UNIT
MOBILE TELEPHONE
PAGER
19
20
21
CELLULAR STATION
18
PAGING TRANSMITTER
30
REMOTE MTSO
22
28
MTSO
MEMORY
16
17
UMS
MEMORY
24
26
MESSAGE MANAGER
15
CSO
14
CALLING DEVICE
12
10

FIG. 1

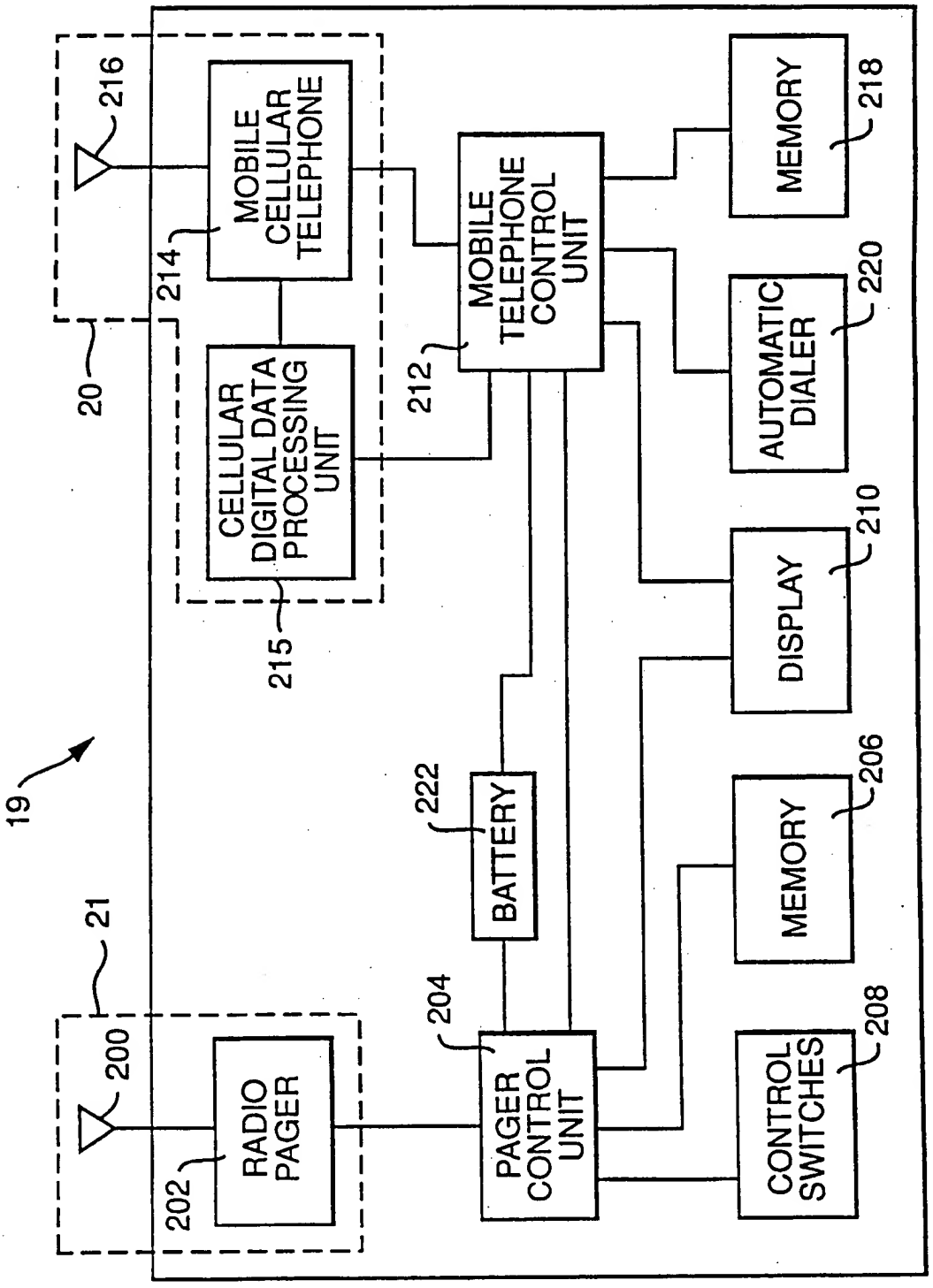
19
21
200
RADIO PAGER
202
204
PAGER CONTROL UNIT
222
BATTERY
20
214
MOBILE CELLULAR TELEPHONE
216
CELLULAR DIGITAL DATA PROCESSING UNIT
215
212
MOBILE TELEPHONE CONTROL UNIT
MEMORY
218
AUTOMATIC DIALER
220
DISPLAY
210
MEMORY
206
CONTROL SWITCHES
208

FIG. 2

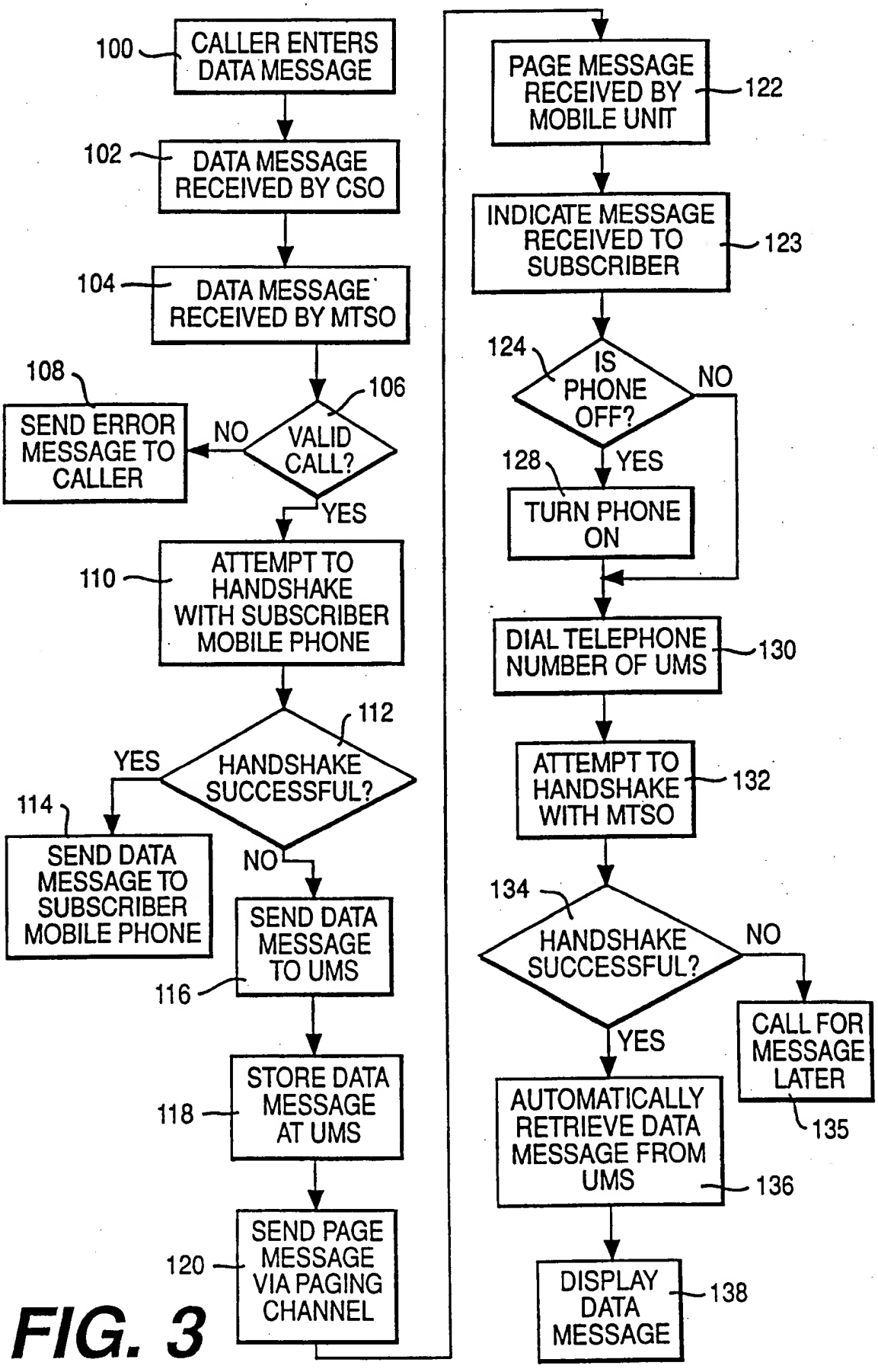
100
CALLER ENTERS DATA MESSAGE
102
DATA MESSAGE RECEIVED BY CSO
104
DATA MESSAGE RECEIVED BY MTSO
106
VALID CALL?
NO
108
SEND ERROR MESSAGE TO CALLER
YES
110
ATTEMPT TO HANDSHAKE WITH SUBSCRIBER MOBILE PHONE
112
HANDSHAKE SUCCESSFUL?
YES
114
SEND DATA MESSAGE TO SUBSCRIBER MOBILE PHONE
NO
SEND DATA MESSAGE TO UMS
116
STORE DATA MESSAGE AT UMS
118
SEND PAGE MESSAGE VIA PAGING CHANNEL
120
PAGE MESSAGE RECEIVED BY MOBILE UNIT
122
INDICATE MESSAGE RECEIVED TO SUBSCRIBER
123
124
IS PHONE OFF?
NO
YES
128
TURN PHONE ON
DIAL TELEPHONE NUMBER OF UMS
130
ATTEMPT TO HANDSHAKE WITH MTSO
132
134
HANDSHAKE SUCCESSFUL?
NO
CALL FOR MESSAGE LATER
135
YES
AUTOMATICALLY RETRIEVE DATA MESSAGE FROM UMS
136
DISPLAY DATA MESSAGE
138

FIG. 3

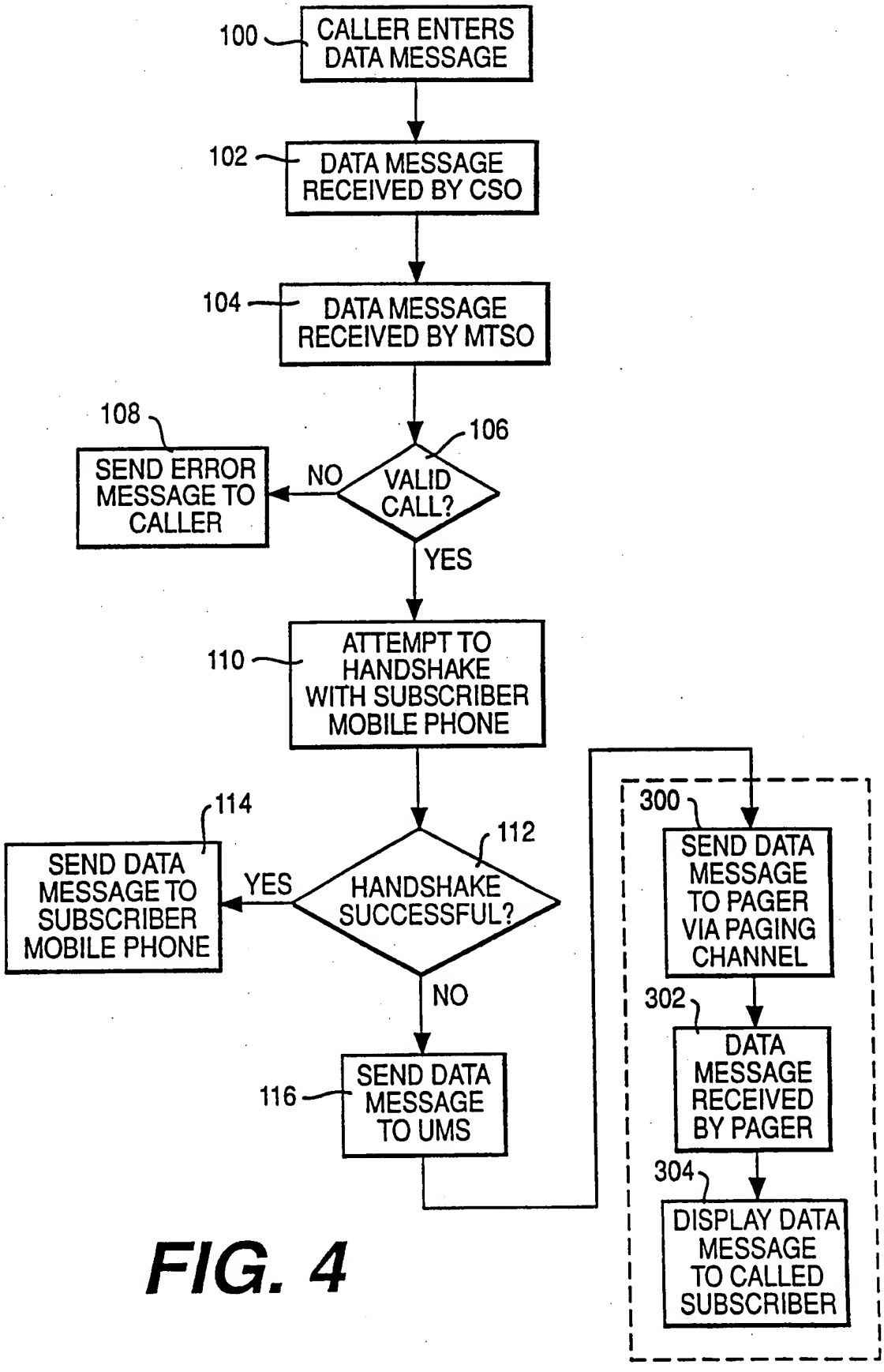
100
CALLER ENTERS DATA MESSAGE
102
DATA MESSAGE RECEIVED BY CSO
104
DATA MESSAGE RECEIVED BY MTSO
106
VALID CALL?
NO
108
SEND ERROR MESSAGE TO CALLER
YES
110
ATTEMPT TO HANDSHAKE WITH SUBSCRIBER MOBILE PHONE
112
HANDSHAKE SUCCESSFUL?
YES
114
SEND DATA MESSAGE TO SUBSCRIBER MOBILE PHONE
NO
116
SEND DATA MESSAGE TO UMS
300
SEND DATA MESSAGE TO PAGER VIA PAGING CHANNEL
302
DATA MESSAGE RECEIVED BY PAGER
304
DISPLAY DATA MESSAGE TO CALLED SUBSCRIBER

FIG. 4

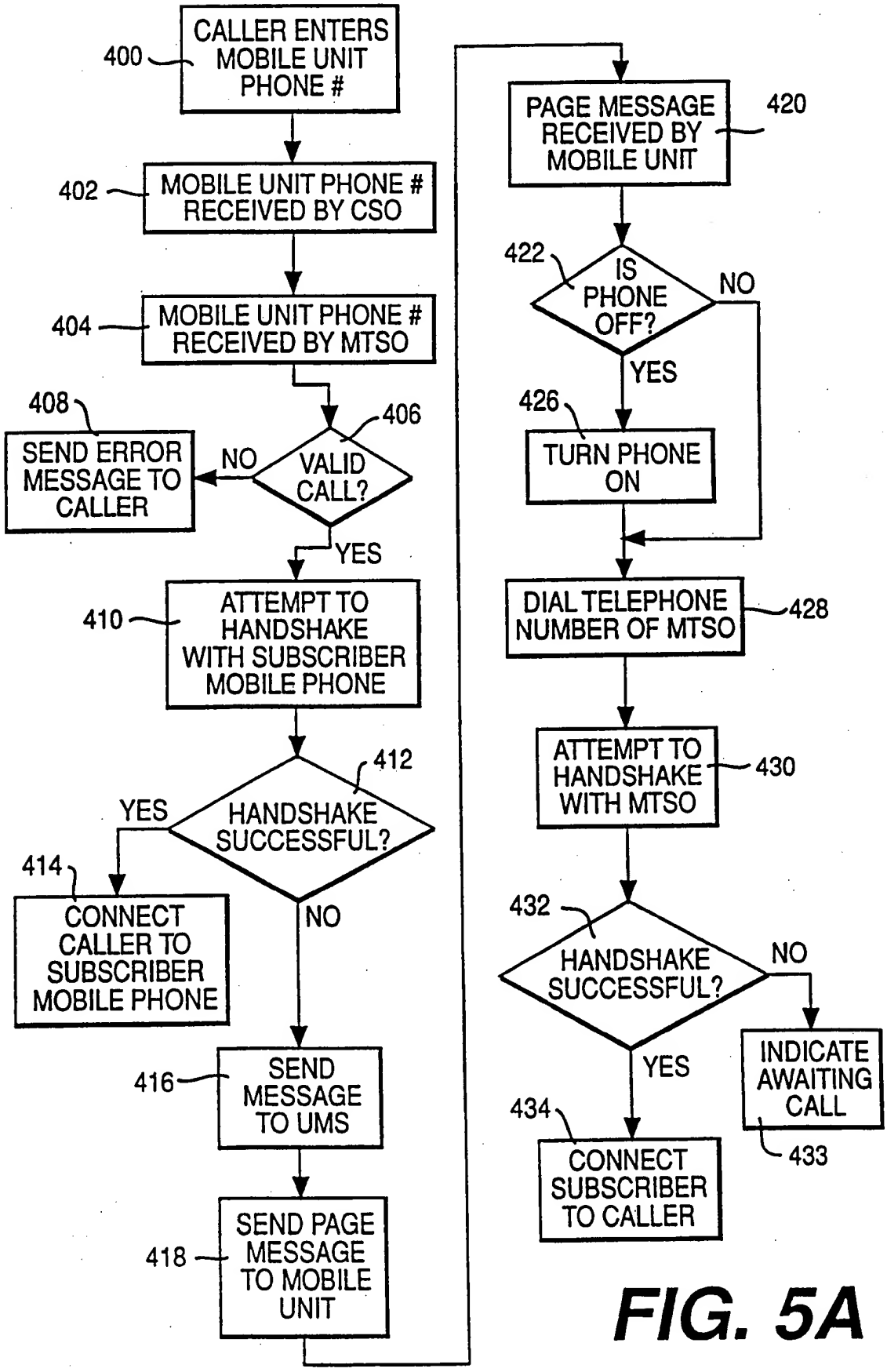
CALLER ENTERS MOBILE UNIT PHONE #
400
MOBILE UNIT PHONE # RECEIVED BY CSO
402
MOBILE UNIT PHONE # RECEIVED BY MTSO
404
VALID CALL?
406
NO
SEND ERROR MESSAGE TO CALLER
408
YES
ATTEMPT TO HANDSHAKE WITH SUBSCRIBER MOBILE PHONE
410
HANDSHAKE SUCCESSFUL?
412
YES
NO
CONNECT CALLER TO SUBSCRIBER MOBILE PHONE
414
SEND MESSAGE TO UMS
416
SEND PAGE MESSAGE TO MOBILE UNIT
418
PAGE MESSAGE RECEIVED BY MOBILE UNIT
420
IS PHONE OFF?
422
NO
YES
TURN PHONE ON
426
DIAL TELEPHONE NUMBER OF MTSO
428
ATTEMPT TO HANDSHAKE WITH MTSO
430
HANDSHAKE SUCCESSFUL?
432
NO
YES
INDICATE AWAITING CALL
433
CONNECT SUBSCRIBER TO CALLER
434

FIG. 5A

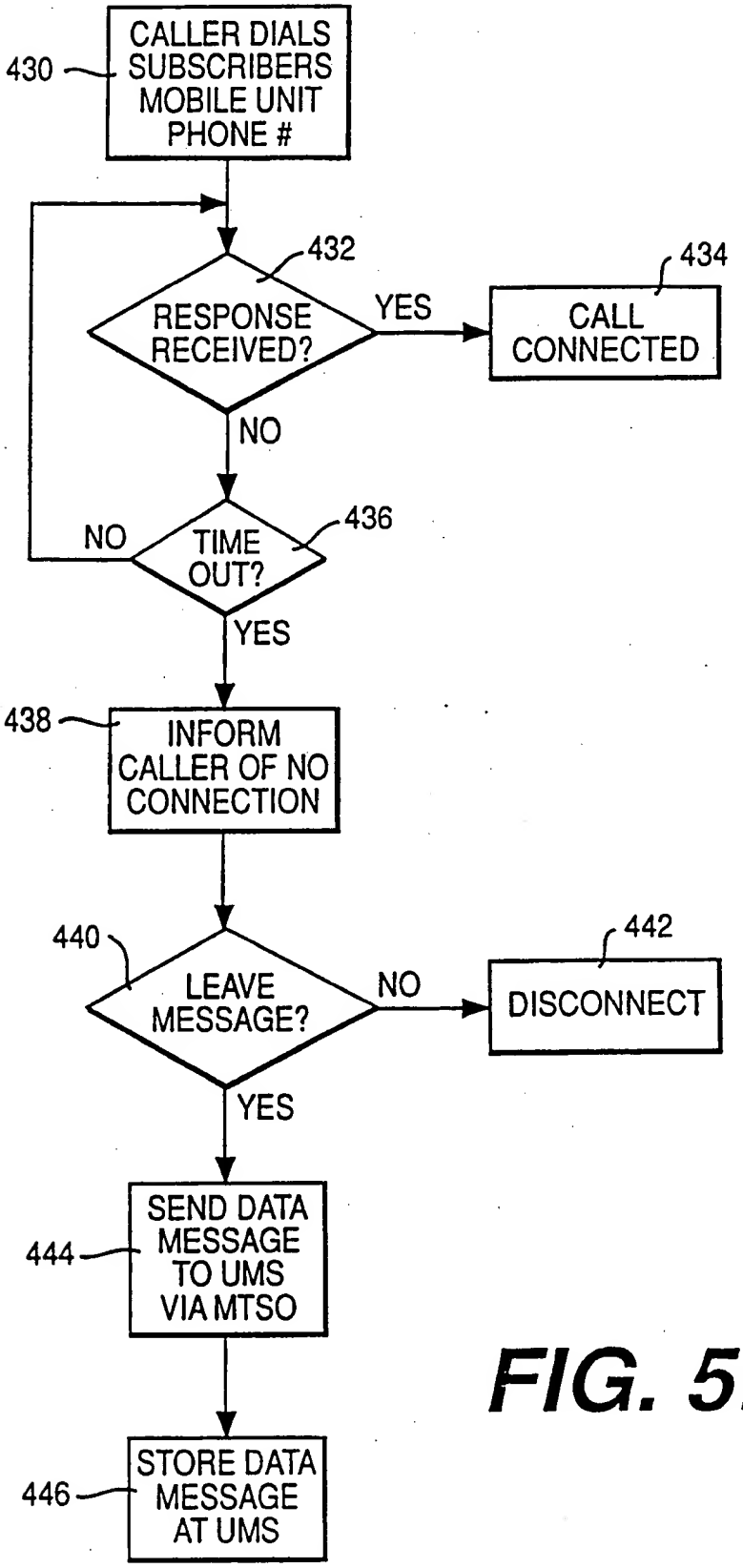
CALLER DIALS SUBSCRIBERS MOBILE UNIT PHONE #
430
RESPONSE RECEIVED?
432
YES
CALL CONNECTED
434
NO
TIME OUT?
436
NO
YES
INFORM CALLER OF NO CONNECTION
438
LEAVE MESSAGE?
440
NO
DISCONNECT
442
YES
SEND DATA MESSAGE TO UMS VIA MTSO
444
STORE DATA MESSAGE AT UMS
446

FIG. 5B

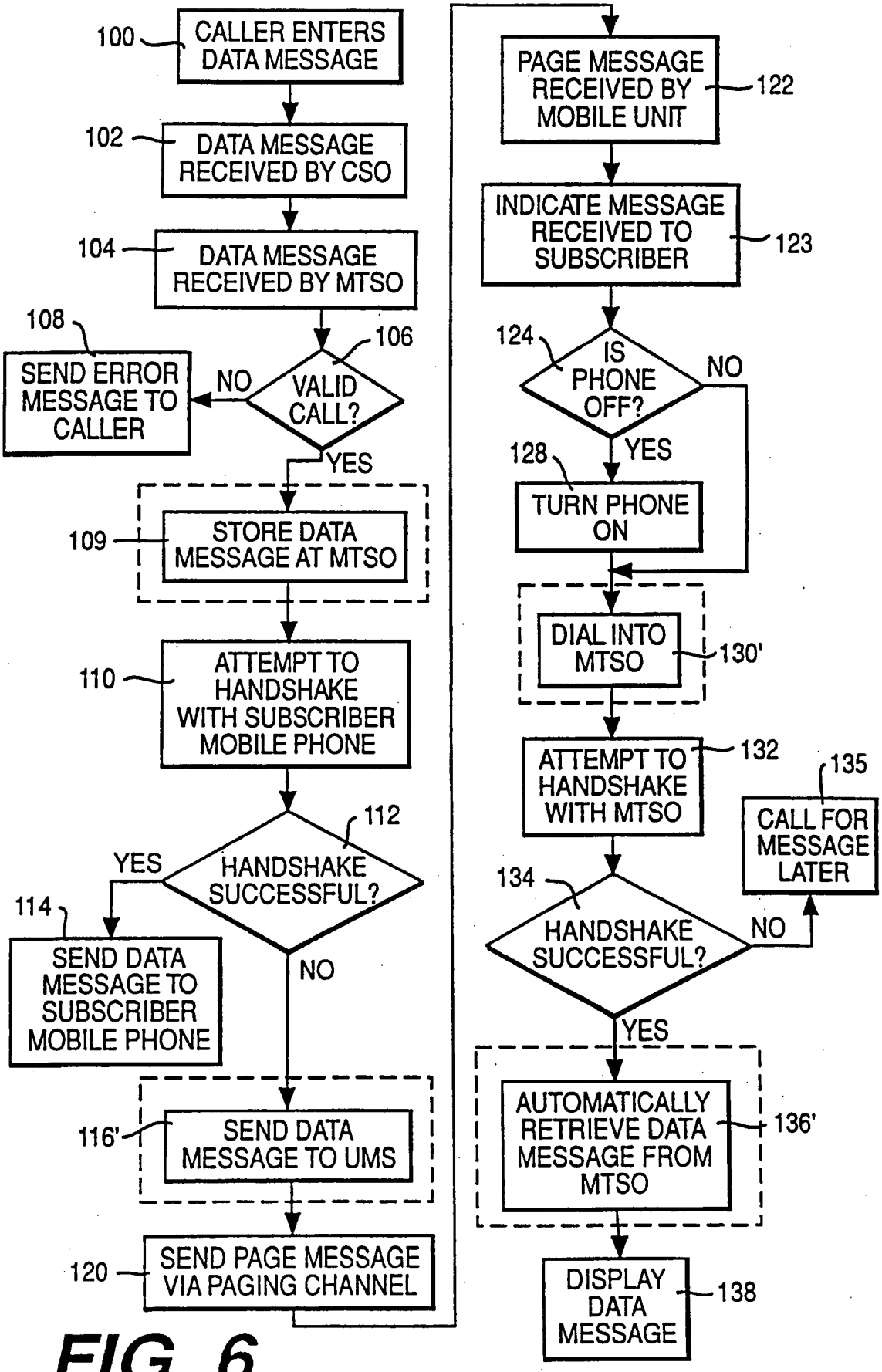
100
CALLER ENTERS DATA MESSAGE
102
DATA MESSAGE RECEIVED BY CSO
104
DATA MESSAGE RECEIVED BY MTSO
106
VALID CALL?
NO
108
SEND ERROR MESSAGE TO CALLER
YES
109
STORE DATA MESSAGE AT MTSO
110
ATTEMPT TO HANDSHAKE WITH SUBSCRIBER MOBILE PHONE
112
HANDSHAKE SUCCESSFUL?
YES
114
SEND DATA MESSAGE TO SUBSCRIBER MOBILE PHONE
NO
116'
SEND DATA MESSAGE TO UMS
120
SEND PAGE MESSAGE VIA PAGING CHANNEL
122
PAGE MESSAGE RECEIVED BY MOBILE UNIT
123
INDICATE MESSAGE RECEIVED TO SUBSCRIBER
124
IS PHONE OFF?
NO
YES
128
TURN PHONE ON
130'
DIAL INTO MTSO
132
ATTEMPT TO HANDSHAKE WITH MTSO
135
CALL FOR MESSAGE LATER
134
HANDSHAKE SUCCESSFUL?
NO
YES
136'
AUTOMATICALLY RETRIEVE DATA MESSAGE FROM MTSO
138
DISPLAY DATA MESSAGE

FIG. 6

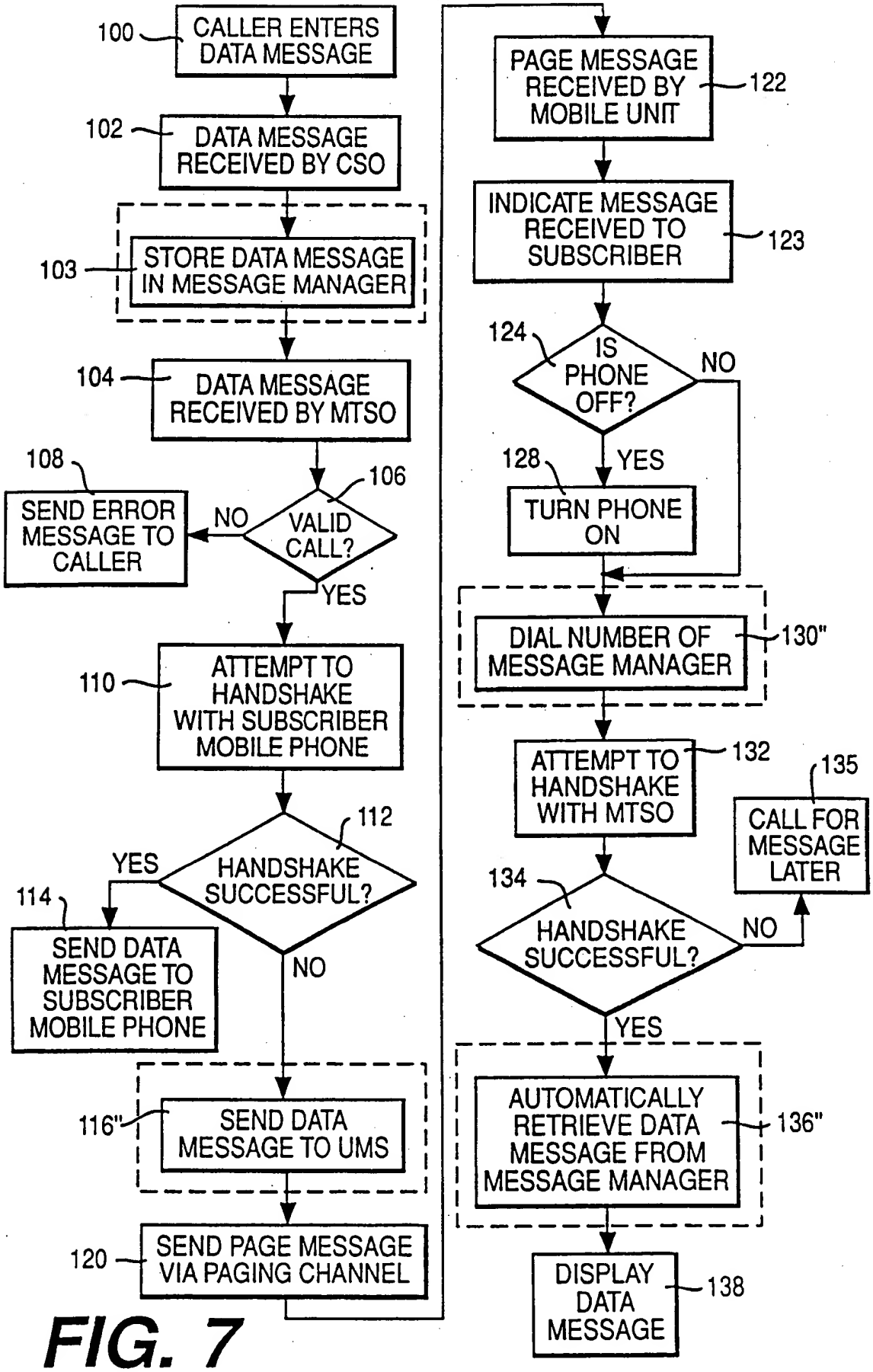
100
CALLER ENTERS DATA MESSAGE
102
DATA MESSAGE RECEIVED BY CSO
103
STORE DATA MESSAGE IN MESSAGE MANAGER
104
DATA MESSAGE RECEIVED BY MTSO
106
VALID CALL?
NO
108
SEND ERROR MESSAGE TO CALLER
YES
110
ATTEMPT TO HANDSHAKE WITH SUBSCRIBER MOBILE PHONE
112
HANDSHAKE SUCCESSFUL?
YES
114
SEND DATA MESSAGE TO SUBSCRIBER MOBILE PHONE
NO
116"
SEND DATA MESSAGE TO UMS
120
SEND PAGE MESSAGE VIA PAGING CHANNEL
122
PAGE MESSAGE RECEIVED BY MOBILE UNIT
123
INDICATE MESSAGE RECEIVED TO SUBSCRIBER
124
IS PHONE OFF?
NO
YES
128
TURN PHONE ON
130"
DIAL NUMBER OF MESSAGE MANAGER
132
ATTEMPT TO HANDSHAKE WITH MTSO
135
CALL FOR MESSAGE LATER
134
HANDSHAKE SUCCESSFUL?
NO
YES
136"
AUTOMATICALLY RETRIEVE DATA MESSAGE FROM MESSAGE MANAGER
138
DISPLAY DATA MESSAGE

FIG. 7

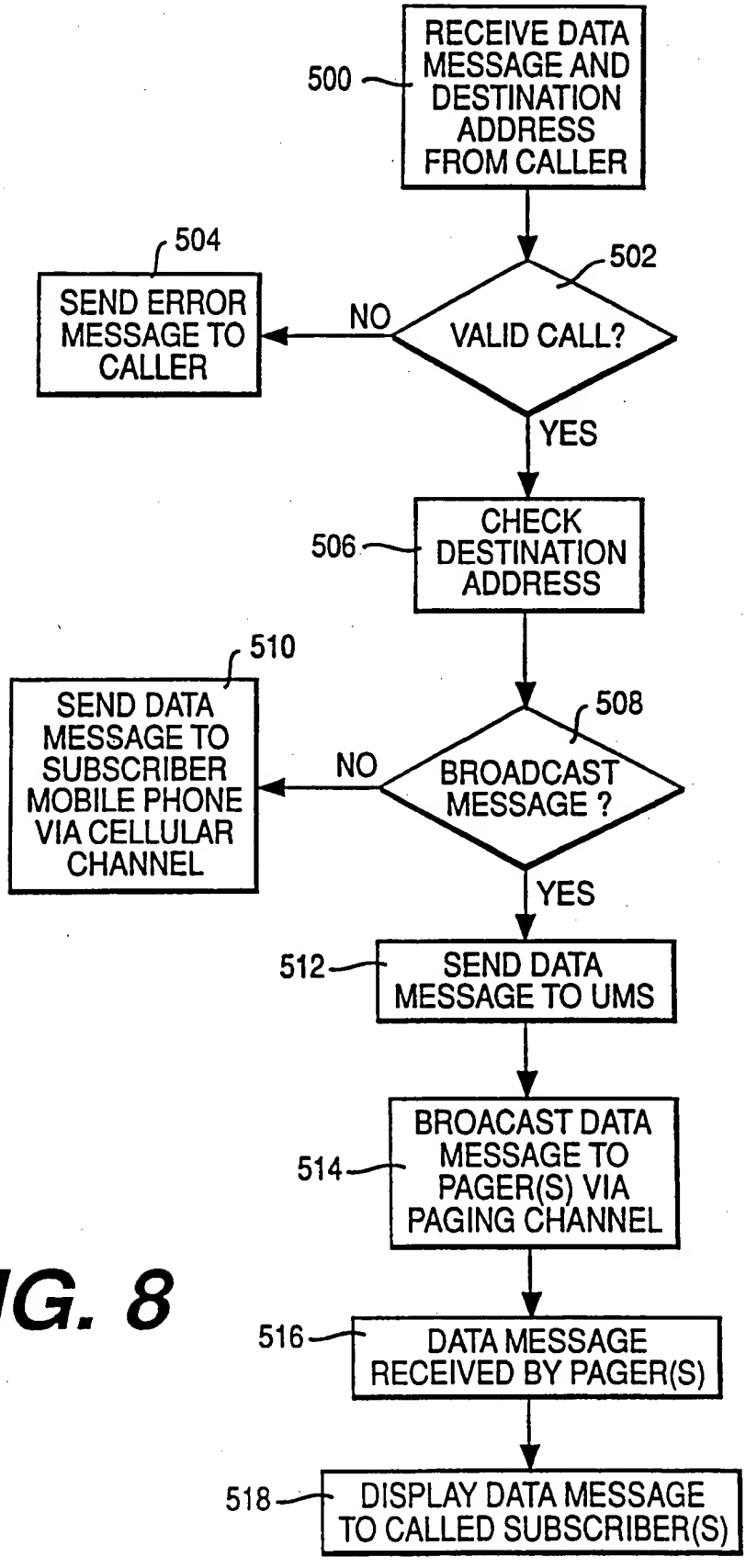
500
RECEIVE DATA MESSAGE AND DESTINATION ADDRESS FROM CALLER
502
VALID CALL?
NO
504
SEND ERROR MESSAGE TO CALLER
YES
506
CHECK DESTINATION ADDRESS
508
BROADCAST MESSAGE ?
NO
510
SEND DATA MESSAGE TO SUBSCRIBER MOBILE PHONE VIA CELLULAR CHANNEL
YES
512
SEND DATA MESSAGE TO UMS
514
BROACAST DATA MESSAGE TO PAGER(S) VIA PAGING CHANNEL
516
DATA MESSAGE RECEIVED BY PAGER(S)
518
DISPLAY DATA MESSAGE TO CALLED SUBSCRIBER(S)

FIG. 8

INTERNATIONAL SEARCH REPORT

Intern[illegible]l Application No
PCT/US 95/03046

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04Q7/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	EP-A-0 503 813 (AMERICAN TELEPHONE AND TELEGRAPH COMPANY) 16 September 1992 see the whole document ---	1-6, 8-39,41 42,45
X	6 TH WORLD TELECOMMUNICATION FORUM , October 1991 GENEVA, CH, pages 375-378, PÖYHÖNEN 'GSM PLMN makes a Mobile Office Viable'	1-6, 15-27
A	see paragraph 3.4 ---	13,28, 34,42,45
X	US-A-5 109 400 (PATSIOKAS ET AL.) 28 April 1992	1-7,9, 10, 13-27, 34-41
A	see the whole document --- -/--	42,45

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
4 July 1995	18.07.95

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Janyszek, J-M

Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO-A-93 25052 (PAGEMART) 9 December 1993 see page 23, line 19 - page 26, line 16 see page 31, line 29 - page 32, line 28; figures	1,6,8, 13,15, 16,22, 28,34, 41,42,45
A	DATA COMMUNICATIONS, vol. 23, no. 5, 21 March 1994 NEW YORK US, pages 61-67, XP 000432066 MILLER 'Cellular Essentials for Wireless Data Transmission'	2-5, 18-21, 24-27, 30-33, 36-39
A	EP-A-0 514 360 (ERICSSON) 19 November 1992 see abstract see column 7, line 51 - column 9, line 57; figures	10,12,14
A	FR-A-2 672 756 (TELEDIFFUSION DE FRANCE) 14 August 1992 see page 4, line 13 - page 6, line 18; figures see page 7, line 11 - line 16	1,6,8, 13,15, 22,23, 28,34, 41,42,45
P,X	WO-A-94 13070 (MOTOROLA) 9 June 1994 see claims	13,14

5

INTERNATIONAL SEARCH REPORT

...information on patent family members

Inter... Application No
PCT/US 95/03046

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
EP-A-503813	16-09-92	JP-A-	5103371	23-04-93
US-A-5109400	28-04-92	NONE		
WO-A-9325052	09-12-93	US-A-	5361399	01-11-94
		CA-A-	2114851	23-12-93
		EP-A-	0598889	01-06-94
		JP-T-	7501195	02-02-95
EP-A-514360	19-11-92	JP-A-	6164487	10-06-94
FR-A-2672756	14-08-92	NONE		
WO-A-9413070	09-06-94	US-A-	5392452	21-02-95
		AU-B-	5617794	22-06-94
		CN-A-	1095881	30-11-94